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By MAJ G. Damon Wells

The ability to move while wearing a full combat load and handle bulky and heavy equipment is vital to the combat mission of most Soldiers, especially the field artilleryman's. The cannoneer's duties are multifaceted, including a variety of multiplane movements that involve the rotation and extension/flexion of every joint in the body with and without added external resistance. To be optimally effective, Soldiers must be trained and primed in proper body mechanics and injury prevention. The potential for injury is always present and must be contemplated by first-line supervisors and leaders before every mission and during day-to-day activities. Due to the impact of productivity lost to injuries, specific awareness of injury prevention should be practiced in every field artillery unit, and it should be part of weekly physical training. It is important to understand why these injuries occur and more importantly how can they be prevented.

A chronic or recurring injury is a Soldier's worst nightmare. These injuries can affect both mission accomplishment and career productivity. The prevalence of work-related lower back injuries is on the rise. With the Army's current operational tempo and little foreseeable relief, it makes sense to implement a lower back injury prevention plan to keep artillerymen healthy and in the fight longer. About 60 to 80 percent of Americans experience lower back problems and the related consequences during their lifetimes. For individuals who are physically active and engage in repeated lifting of heavy items, the risks are increased. It was estimated from a 2007 study that back pain affects more than 150,000 Soldiers yearly, accounting for compromised missions, lost productivity and higher healthcare costs.

The primary enemies related to lower back injuries include improperly executed heavy physical work; inappropriate static posture; repetitive work without proper rest; slipping, tripping or falling; twisting while the spine is loaded; vibration while driving heavy vehicle; fatigue/poor muscle endurance; "attitude" at work leading to poor decisions; and mental fatigue impeding lifting techniques. An evaluation of these tasks reveals that 90 percent of them fall within the duty description of a Soldier. Luckily, by mitigating these risks, lower back injury is one of the most preventable ailments in the Army.

Mechanics. The architecture of the human body is both complex and resilient. The spine, for example, is capable of supporting thousands of pounds and, when treated properly, can last a lifetime injury

Photo by Jennifer Blais (*Fires* Bulletin)

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free. Unfortunately, many Soldiers are never taught the proper mechanics for lifting and frequently sustain lower back injuries. In addition, most Army units use running as the primary tool for cardio respiratory fitness development, which adds to physical stress the spine receives throughout an entire military career. Because the spine is comprised of a series of vertebrae separated by connective tissue (cartilage), it is inherently susceptible to injury due to improper use. When the connective tissue is pinched between two vertebrae (uneven disk compression), injury is likely. Proper lifting mechanics ensures that the disks are aligned properly over the cartilage and that the compression forces are equally distributed. Implementing a lower back injury prevention program should be based on appropriate knowledge and application of biomechanics and training techniques and also must include a variety of activities for cardio respiratory fitness that provides relief to physical stress on the spine and vertebrae.

The proper application of biomechanics and proper body alignment is a crucial component of lower back injury prevention. The spine can be engaged in a number of ways, but there are a few ways to place the body into proper lifting positions that minimize the risk of injury. Notably, a rounded back should be avoided at all costs. It is worth the time to take a block of physical training time to train how to employ an "active back."

An active back ensures the spinal erectors (low back) and hamstring muscles are engaged properly and can work without risk of damage to connective tissue or muscle. To train an active back, one's spine must be straight or slightly arched with shoulders (shoulder blades) retracted and flexed. From the side there should be a straight line from the base of the spine just above the buttocks to the base of the skull. The knees should be bent to whatever degree is necessary, and the head should remain in a neutral position. Avoid the common misperception to look up as this puts the cervical spine in an unnatural position. To lift with the active back, extend your shoulders up while maintaining the straight back position.

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Weak hamstrings and lower back muscles can cause a rounding of the back, which is extremely harmful and to be avoided. Also, many Soldiers have overly tight back and hamstrings that can cause a rounding of the lower back. This can be corrected with proper training and flexibility drills (stretching). Furthermore, adding a dedicated block of instruction on the active back indicates to the Soldiers in your formation that it is important to maintain proper posture under exertion. It would also give them the knowledge to make corrections when they see improper lifting techniques employed by other members of the unit.

Prevention plan. Field artillery leaders must incorporate three simple concepts into their physical training regimens — strength, mobility and flexibility. The first pillar of the lower back injury prevention plan is strength. A strong structure provides the basis for injury prevention by developing and maintaining tough muscle, bones and connective tissues (tendons and ligaments). The primary focus for lower back injury prevention strength training should be the core muscles, including the abdominals and the oblique complex on each side of the body. These muscles work to provide balance and stability to the spine and ensure better posture throughout the day whether the Soldier is sitting, standing or lifting.

Strength. Strength is developed through the thoughtful application of resistance training on a weekly basis. Three key principles for developing optimal strength are progression, overload and balance. Progression is the week to week improvements that are made during the program. Increased resistance, shorter rest periods and added sets are examples of good progression techniques. The key to progression is adding small improvements each week. Those small increases in intensity are known as overload. By keeping track of workouts, small unit leaders can ensure that each Soldier is making weekly progress by using the overload principle, thus becoming stronger. Be cautious about using the typical "more is better" technique. Small increments over time yield the best and longest lasting results, and they are less likely to lead to injury, as well.

Another vital component of strength is balance. Unlike the traditional definition (maintaining one's equilibrium), balance as a component of strength references equal distribution of work across the entire body. This is also a key component of injury prevention, and leaders must monitor workouts to ensure that all muscles are worked equally. Units that focus heavily on pushups (not pull-ups), sit-ups (not lower back) or upper body (not lower body) are at a higher risk for injury. Training out of balance is common throughout the Army and is one of the easiest fixes for injury prevention.

Mobility. Mobility is the second pillar of the lower back injury prevention plan. Mobility is the ability to translate force into productive movement. This is especially applicable in combat situations, where efficient movement is critical and chances of injury are high. Broadly defined, mobility includes tasks such as jumping, landing and changing directions quickly (agility). Because force is being applied to many parts of the body at changing degrees and directions, the chance of sustaining an injury during mobility operations is high. Implementing appropriate mobility drills into a physical training program is essential. In addition, mobility drills can be a great substitute to the development of high intensity cardio respiratory fitness and can ease the impact of a traditional four to five times a week running program. Mobility drills not only give you an opportunity to train the transferability of weight, but also allows for the inclusion of some variety into your physical development programs.

Flexibility. Flexibility, while frequently under employed, is

To be optimally effective, Soldiers must be trained and primed in proper body mechanics and injury prevention. The potential for injury is always present and must be contemplated by first-line supervisors and leaders before every mission and during day-to-day activities. (Photo by Timothy L. Hale)

vital to lower back injury prevention because overly tight muscles are a frequent cause of strains in the low back and hamstrings. For example, a tight hamstring muscle changes the anatomical position of the pelvis and changes the amount of stress that the lower back's vertebrae receive during movement. While Soldiers do not need to be as flexible as yoga and martial arts participants to be mission capable, they do need a requisite amount of flexibility to mitigate lower back injuries as much as possible. Tight muscles in the core (including lower back) and hamstring area are one of the most common causes of lower back injury.

During movement, whether it is mobility oriented or lifting objects, inflexible muscles prevent a full range of motion and force supporting muscles to compensate and put undo stress on joints and connective tissue. This stress can lead to an acute injury, like a muscle tear or strain, or a chronic injury that leads to lower back pain over time. Flexibility training should not be confused with warm-up drills. Before physical training, units should focus on warming the muscles in preparation for movement. Flexibility training is most effective after physical training is finished, when muscle are loose and pliable. Employing weekly flexibility training at the end of morning physical training is a valuable tool in a lower back injury prevention plan.

Flexibility programs also can be conducted in isolation at the individual level in any environment. After a several drills in the field, muscles can become tight and may need some flexibility exercises to return them to their normal length and so they can continue to function properly. Every time there is a significant amount of muscular activity, Soldiers must consider a quick stretch of the larger muscles of the body.

Implementing a training program oriented on a well executed lower back injury prevention plan is a simple task and is a necessity at the battery level. First, ensure that batteries are planning detailed physical training programs at least eight weeks in advance. This is enough time to verify that all units are employing a logical progression in their routines. The initial stages of the routine should include plenty of core-strengthening work, such as abdominal, hip flexor and lower back focused exercises.

These workouts also should be closely monitored by junior leaders to ensure that every Soldier uses proper biomechanics and an active back. Daily operations should be monitored for the same reasons. Keep the workouts similar enough to see some overload at each workout. If every workout is completely different, it is difficult to determine if one workout was more intense than the last, as this becomes a subjective matter.

Incorporating balance into the weekly regimen is also important. Place an equal value on every muscle group to prevent muscular imbalances that inevitably lead to injuries. Lastly, make every member of unit an advocate of your lower back injury prevention plan program. If they are all looking after each other, proper techniques will be applied, lower back injuries will be minimized and productivity and quality of life will be improved.

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